Waterhemp rears its ugly head ... again

January 26 2011

University of Illinois researchers identified the first HPPD-resistant population of waterhemp in this Illinois seed corn field. Credit: Photo by Aaron Hager, University of Illinois

Waterhemp has done it again. University of Illinois researchers just published an article in Pest Management Science confirming that waterhemp is the first weed to evolve resistance to HPPD-inhibiting herbicides.

"A fifth example of resistance in one weed species is overwhelming evidence that resistance to virtually any herbicide used extensively on this species is possible," said Aaron Hager, U of I Extension weed specialist.

Waterhemp is not a weed species that can be adequately managed with one or two different herbicides, Hager said. This troublesome weed requires a much more integrated approach.

"Large-scale agronomic crop production systems currently depend on herbicides for weed management," Hager said. "A weakness in this approach lies in its strength; because herbicides are so effective, they exert tremendous selection pressures that, over time, result in resistant weed populations as natural outcomes of the evolutionary process."

In an article in the Journal of Agricultural and Food Chemistry, Hager and Pat Tranel, a U of I professor of molecular weed science in the Department of Crop Sciences, shared the results of a survey of multiple-herbicide resistance in waterhemp. The results showed that all populations resistant to glyphosate were also resistant to ALS inhibitors and 40 percent contained resistance to PPO inhibitors.

Adding HPPD resistance to the mix complicates problems for growers and scientists. When weeds stack several forms of resistance, it greatly reduces the number of viable herbicide options.

"We are running out of options," Hager said. "This multiple-herbicide resistance in waterhemp has the potential to become an unmanageable problem with currently available postemergence herbicides used in conventional or glyphosate-resistant soybean."

Hager said they've already discovered one waterhemp biotype that's resistant to four different herbicide families. He said growers may see five-way resistance in the future.

Fortunately, there are very few annual weed species in the United States that have shown this level of multiple resistance. Waterhemp is a dioecious species and ideally suited for evolving herbicide resistance by sharing resistance genes among populations and biotypes.

"For example, you can have HPPD resistance evolving in field A, and in adjacent field B you can have selection for glyphosate resistance,"

Tranel said. "Pollen is always moving in the air, allowing pollen from field A to mix with resistant plants from field B resulting in HPPD and glyphosate resistance in the same progeny. That's how easy it is to stack resistance."

The pressure is on for industry to develop new options and for growers to change their practices of how they use products to control the weed spectrum, he added.

Hager, Tranel and Dean Riechers, a U of I associate professor of herbicide physiology, were recently awarded a grant from Syngenta to study how waterhemp populations evolve resistance. They will collaborate with Syngenta's scientists to find answers regarding the genetics, inheritance, and mechanisms of resistance to HPPD inhibitors.

"We are excited for the opportunity to collaborate with industry to learn more about these resistant biotypes," Tranel said. "We want to find practical management recommendations for growers."

Hager said that there is only so much a person can learn by looking at different treatments in a field, but if this is not done, it's difficult to come up with the best recommendations. The U of I weed science team's advantage is their ability to span the range from applied field and greenhouse work to basic DNA sequencing, physiology and genetics work.

At least two companies are developing crop varieties that are resistant to HPPD inhibitors. In the future, both of these companies see HPPD-inhibiting herbicides growing in importance.

"We now have known resistance before the resistant crops are on the market," Tranel said. "That's a real concern."

But Hager thinks it could be a blessing in disguise.

"We have time to learn about this type of resistance in advance before these crop varieties hit the market," Hager said. "If these crops are commercialized, we could have the recommendations in place from the onset to slow the evolution of this resistance."

Provided by University of Illinois at Urbana-Champaign